

Seeds and shopping centres

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Abstract

Shopping centres are a rich source of viable seeds and in this study 58 species were raised from sources not intended for cultivation. The species represented 50 genera, belonging to approximately 40% of the currently recognised angiosperm clades. (*The Victorian Naturalist* 127 (1) 2010, 11–14)

Keywords: Shopping centres, viable seeds, seed banks, plant quarantine

Many seeds (and small fruits) present in soils are viable and as such can be regarded as constituting a global seed-bank, the species composition of which varies from place to place. The existence of seed banks long has been recognised and were referred to by Theophrastus (370–288 BCE) who reported that ‘in some places, if the ground is merely lightly worked and stirred, the plants native to the district spring up, for instance the cypress, *Cupressus sempervirens*, in Crete.’ He also noted that plants other than those native to an area may spring up after heavy rain. For example, *Silphium Ferula tingitans* had been known to appear from such cause (heavy rain), where there was none before (Hort 1948). However, it is debatable as to whether the appearance of these plants was due to the germination of seeds that had been long dormant in the soil, or had washed in with flood waters.

In an elegant pioneer paper, Carroll and Ashton (1965) studied the seed-banks of nine Victorian soils. Over a period of six months, beginning in April, they recorded both the numbers and identities of seedlings that sprouted from samples which had been placed on a sterile substrate in a glasshouse and regularly watered.

Though shopping centres are in no sense plant communities, they may be regarded as seed-banks, for on the shelves of some merchants’ premises there are products that contain large numbers of viable seeds. Many of these seeds are sources of food for people or animals, especially birds. Accordingly, the diversity of seeds present on the shelves is far from a random sample of the Earth’s flora.

Seeds tested for viability were purchased in Brisbane shopping centres. They derived from the following sources: dried fruits, bird-seed, pulses, muesli, spice seeds, grains, nuts, sprout-

ing mixtures, herbal medicines, and soil adhering to root vegetables. The seeds extracted from fresh fruits, if imported from overseas, were also tested for viability.

Depending upon the time that has elapsed between their harvest and purchase, the treatment received during storage or to satisfy quarantine regulations, the viability of the seeds tested differed considerably from sample to sample. For example, the percentage germination of several samples of Sweet Basil seeds tested was zero. In contrast, some samples of sesame seed failed to germinate while others were nearly 100% viable. Furthermore, the seeds of some species, including those of Opium Poppy, appeared to be quite fertile, as judged from the proportion of those that germinated and developed to the cotyledon stage, but most seedlings failed to produce more than a few leaves before dying. Rarely, as with the seeds of a few avocados imported from New Zealand, the seedlings produced grew into monstrous chlorophyll-deficient plants.

It is remarkable that a few seeds remain viable despite the damage sustained during processing. Healthy plants have been raised from seeds of pearl barley *Hordeum vulgare*, polished rice *Oryza sativa*, and split peas *Pisum sativum*.

All seeds were tested at ambient temperatures and none, other than those of legumes, were subjected to any pretreatment. Boiling water was poured over the latter to soften any hard seeds. Seed samples which did not promptly germinate were kept under test conditions for many months to allow for the breakdown of dormancy. Soil associated with root crops was maintained under conditions similar to those for testing seed viability. Seedlings from all seed sources were grown until their identities could be confirmed.

From the Appendix it is clear that, from the labelling on packages, viable seeds came from ten countries including Australia. It is likely other countries should be added to the list, for several samples were labelled as deriving from either 'Imported' or 'Local and Imported' sources and so their origin must be regarded as indeterminate. Unlabelled samples were probably sourced in Australia but may have come from overseas.

Although the specific identities of all the seeds purchased were known, the same was not true for the few contaminants encountered. Their identities were determined by germinating the seed and growing the resulting seedlings to maturity.

Two other seed sources encountered in shopping centres were those incorporated in the soil attached to root crops and in Sphagnum Moss. Because these seeds were not part of the product purchased they were regarded as contaminants. The soil samples contained up to six germinable seeds per 100 g of dry soil and these without exception were of Australian adventive species. The most common fellow traveller with the Sphagnum Moss was *Juncus bassianus* whose seeds germinated to produce healthy plants. After several years' cultivation in Brisbane these plants failed to flower but they did so within a few weeks of being transferred to Hobart.

The species raised are listed in the Appendix. About 80% of these are members of Australia's adventive flora. A few of the species, including Variegated Thistles *Silybum marianum*, are noxious weeds (Randall 2002) but most are relatively benign (Anon 2009). However, this does not preclude them from belonging to genotypes that do not occur locally and with which they could compete or interbreed to become aggressive weeds.

Therefore, imported seeds and fruits are subject to strict quarantine regulations (Ebbels 2003), but as noted by Heather and Hallman (2008, p.6) 'Phytosanitary barriers cannot offer absolute security against the entry of a pest species but risk management will reduce the possibility of entry and establishment to acceptable levels.' The concept of what is an acceptable risk level has been the subject of much debate, centred largely on the need to ensure that quarantine regulations do not become a substitute for trade barriers in the form of protectionism.

In this study, 58 species were raised and these represented 50 genera and 19 of the 42 orders and eight other terminal clades recognised by Soltis *et al.* (2005) in their classification of angiosperms. Because the samples tested excluded not only species intended for cultivation but also those locally grown for fresh fruit, this number must be much less than the total available in Brisbane shopping centres. Furthermore, the requirements of customers vary from place to place, as is evidenced by seeds of Lupini Bean being sold only in suburbs with large Greek communities. It would be expected that at a world level the diversity of seeds sold in shopping centres would far exceed those that are available in Brisbane. These centres may, therefore, be regarded collectively as constituting an immense world seed bank, biased in favour of species useful for feeding humankind.

Acknowledgements

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Appendix

Species grown from seeds sold in Brisbane Shopping Centres, for human or animal consumption, plus the contaminants thereof, and those from a few imported fruits. The vernacular names given are those widely used in Australia and the countries from which sourced as given on the packaging. Species names according to Wiersema and Léon (1999).

* = species not known as adventives in Australia (Anon 2009); L&I = Local and Imported.

Species	Vernacular Name	Seed Source
<i>Amaranthus caudatus</i>	Inca-Wheat	Bolivia
<i>Arachis hypogaea</i>	Peanut	Australia
<i>Avena sativa</i>	Oats	Australia
<i>Brassica nigra</i>	Canola	Australia
<i>Carthamus tinctorius</i>	Safflower	Australia, L&I
<i>Castanea sativa</i> *	Chestnut	Australia
<i>Chenopodium quinoa</i>	Quinoa	Bolivia
<i>Cicer arietinum</i> *	Chick Pea	Australia
<i>Citrus limon</i>	Lemon	USA
<i>Citrus paradisi</i> *	Grapefruit	Israel
<i>Citrus reticulata</i> *	Mandarine	USA
<i>Coriandrum sativum</i>	Coriander	India
<i>Cucurbita pepo</i>	Pepitas	China
<i>Cuminum cyminum</i>	Cumin	India
<i>Echinochloa esculenta</i>	Japanese Millet	Australia
<i>Fagopyrum esculentum</i>	Buckwheat	China
<i>Foeniculum vulgare</i>	Fennel	India
<i>Glycine max</i> *	Soya Bean	India
<i>Helianthus annuus</i>	Sunflower	Australia
<i>Hordeum vulgare</i>	Barley	Australia
<i>Juglans regia</i>	Walnut	Australia
<i>Lens culinaris</i>	Lentil	L&I
<i>Litchi chinensis</i> *	Lychee	Thailand, China
<i>Linum usitatissimum</i>	Flax	Australia, China
<i>Lupinus albus</i>	White Lupin	Australia
<i>Lycium barbarum</i>	Gogji or Wolf Berry	China
<i>Lycopersion esculentum</i>	Sundried Tomato	Turkey
<i>Medicago polymorpha</i>	Medick	India
<i>Medicago sativa</i>	Alfalfa, Lucerne	L&I
<i>Nigella sativa</i>	Black cumin	India
<i>Oryza sativa</i>	Rice	Italy
<i>Panicum miliaceum</i>	Millet Panic	Australia
<i>Papaver somniferum</i>	Opium Poppy	India
<i>Persea gratissima</i>	Avocado	New Zealand
<i>Peucedanum graveolens</i>	Dill	India
<i>Phalaris canariensis</i>	Canary Grass	Australia
<i>Phaseolus limensis</i> *	Lima Bean	USA
<i>Phaseolus vulgaris</i>	Kidney Bean	USA
<i>Phoenix dactylifera</i>	Date Palm	Turkey
<i>Pimpinella anisum</i> *	Anise	Turkey
<i>Pisum sativum</i>	Garden Pea	New Zealand
<i>Prunus dulcis</i> *	Almond	Australia
<i>Punica granatum</i>	Pomegranate	USA
<i>Salvia hispanica</i> *	Chia	Australia
<i>Secale cereale</i>	Rye	Australia
<i>Sesamum indicum</i>	Sesame Seed	Australia
<i>Silybum marianum</i>	Variiegated Thistle	Australia
<i>Sorghum bicolor</i>	Grain Sorghum	Australia
<i>Trachyspermum copticum</i> *	Caraway	India
<i>Trigonella foenum-graecum</i>	Fenugreek	India
<i>Triticum aestivum</i>	Wheat	Australia
<i>Vaccinium corymbosum</i> *	Highbush Blueberry	New Zealand

Appendix cont.

Species	Vernacular Name	Seed Source
<i>Vicia faba</i>	Broad Bean	Australia
<i>Vigna angularis</i> *	Adzuki Bean	Australia
<i>Vigna radiata</i> *	Mung Bean	Australia, L&I
<i>Vigna sinensis</i>	Cow Pea	USA
<i>Zea mays</i>	Maize	L&I

One Hundred Years Ago

VICTORIAN VEGETATION IN THE MELBOURNE BOTANIC GARDENS BY F. PITCHER.

(Read before the Field Naturalists' Club of Victoria, 11th Jan., 1910.)

IT is hardly to be expected that one could find anywhere within a radius of 2½ miles of the centre of so prosperous a State capital as Melbourne even the smallest area of land in anything like the natural condition in which it existed seventy years earlier, to say nothing of ever hoping to trace within such an area a mass of vegetation anything approaching the natural condition in which it existed prior to that time. It may, however, be remarked with a great deal of pleasure, and to the credit of the persons concerned, whether they have passed away or are still living, that there are yet to be seen, within a very short distance of Melbourne, in our Royal, Studley, Richmond and Yarra parks, numerous specimens of Eucalyptus, Casuarina, and Acacia, now, perhaps, of very limited species, which serve to indicate, in part, the character of the natural vegetation which existed on the site of our city prior to its discovery and subsequent settlement. In addition, there yet remain to-day along the banks of the River Yarra, on which our city is built, and its tributary creeks, within a very short distance of the metropolis, Acacia, Bursaria, Melaleuca, and other plants in their natural condition, which afford additional evidence of the character of the vegetation which previously occupied the site of Melbourne and its flourishing suburbs.

Now, when we consider that in the small area so wisely selected by the first Lieutenant-Governor of Victoria, the Hon. Charles Joseph La Trobe, in 1840 as a Botanic Gardens site, since increased to about 100 acres, there have been going on continuous changes and transformations of the surface conditions, such as by the erection of a stately vice-regal residence in its vicinity; the providing of suitable approaches and thoroughfares to and from the city for its population living in the adjoining southern suburbs; the improvements of the course and southern bank of the Yarra, which forms one of the boundaries of the site; and, last but not least, the remodelling and improving of the Gardens themselves according to the varying ideas of the different directors from time to time during the period, named, it is almost unreasonable to think that any native vegetation would remain of that which existed prior to the discovery of the State, yet there are still: a few trees living within our Botanic Gardens which were flourishing on the site before the advent of the first of our white, population. It is to draw attention to these, with the hope of their being retained as long as ever possible as memorials of such original vegetation, that they are here referred to and their condition at this date mentioned.

For a number of years after 1869, when the writer was first introduced to the office and service of the late Baron von Mueller by Mr. A. C. Neate, a faithful former official of the Gardens staff for over* 40 years, there remained in the north-eastern portion of the grounds an island area cut off from the surrounding land by a narrow strip of the then lagoon waters. This area was densely covered with the Swamp Tea-tree, *Melaleuca ericifolia*, which in many parts was surmounted with the Scrub Vine, *Cassytha melantha*. Clumps of the Sword Rush, *Lepidosperma elatius*, were scattered amongst this tea-tree, and several Red Gum trees, *Eucalyptus rostrata*, were striking objects in the vicinity, while around the margins and in the adjoining lagoon-waters were thriving luxuriantly, in their natural condition, numerous aquatic plants, including the Native Bulrush, *Typha angustifolia*. Patches of the tea-tree are still to be found growing in this locality, and are shown in the photographs here to-night. These I had taken some time ago with the object of retaining a remembrance of the existence of this wild corner should those patches be found to vanish by reason of further artificial alteration of the surface, or by the requirements of exotic vegetation in their vicinity.

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